High Availability and Redundancy in Catalyst 4500 Series Switches

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Introduction

This document provides information on the high availability and redundancy features available on the Catalyst 4500 Series Switches. Specifically, this document describes the Catalyst 4507Rs and Catalyst 4510Rs with redundant Supervisor II+, IV, V modules. Some sections, which are noted, are applicable to all 4500 chassis (4503, 4506, 4507R, and 4510R).

High availability is a critical requirement of most networks today. The switch downtime needs to be minimal to ensure maximum productivity in a network. The Catalyst 4500 Series Switches provide many features to achieve this goal.

High availability and redundancy in a Catalyst 4500 Series Switch is achieved through these features:

- Supervisor Redundancy Route Processor Redundancy (RPR) and Stateful Switchover (SSO)
- Supervisor Uplink Redundancy
- Power Supply Redundancy
- Hot Standby Router Protocol (HSRP)
- Port−Channel

This document considers each one of these features in more detail specific to this platform. This document also provides sample scenarios or configurations to illustrate them.

Prerequisites

Requirements

There are no specific requirements for this document.

Components Used

The information in this document is based on these software and hardware versions:

- Catalyst 4507R with dual Supervisor IV modules
- Cisco IOS® Software Release 12.1(13)EW for RPR Configuration
- Cisco IOS Software Release 12.2(31)SG for SSO Configuration

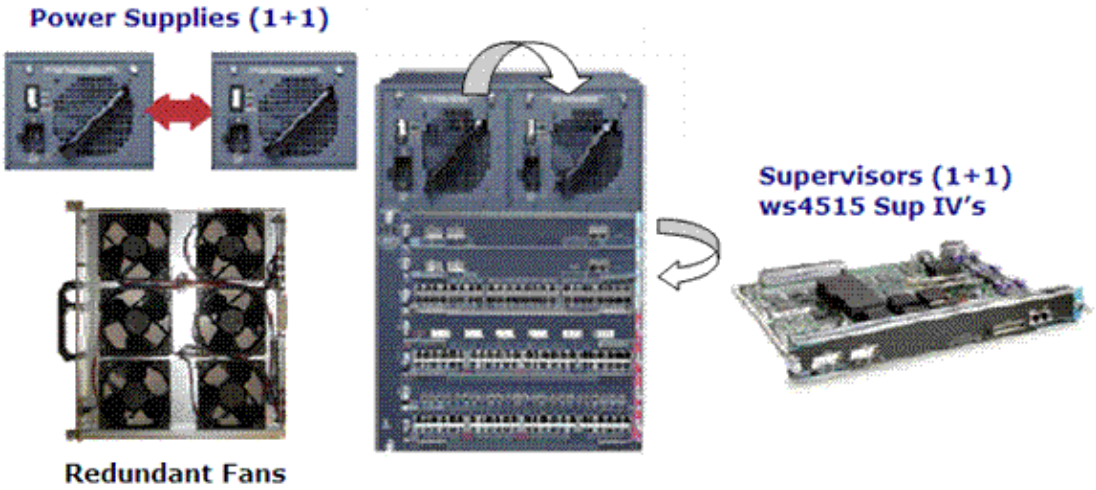
The information presented in this document was created from devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, make sure that you understand the potential impact of any command.

Conventions

Refer to Cisco Technical Tips Conventions for more information on document conventions.

Supervisor Redundancy

Catalyst 4500 Series Switches support redundant supervisor engines only on the 4507R and 4510R chassis. Redundancy is not supported with earlier supervisor modules (Supervisor I/II/III). The two supervisors should be inserted into slots 1 and 2 only.



Chassis	Supported Redundant Supervisor Engines
Catalyst 4507R (WS−C4507R)	• Supervisor Engine II−Plus (WS−X4013+) • Supervisor Engine II−Plus−10GE (WS−X4013+10GE)

	• Supervisor Engine IV (WS−X4515) • Supervisor Engine V (WS−X4516) • Supervisor Engine V−10GE (WS−X4516−10GE)
Catalyst 4510R (WS−C4510R)	• Supervisor Engine V (WS−X4516) • Supervisor Engine V−10GE (WS−X4516−10GE)

Catalyst 4500 Series Switches allow a redundant supervisor engine to take over if the active supervisor engine fails. In software, supervisor engine redundancy is enabled by running the redundant supervisor engine in RPR or SSO operating mode.

Note: The RPR and SSO redundancy modes require both supervisor engines in the chassis to be of the same supervisor engine model and to use the same Cisco IOS software image.

With supervisor engine redundancy enabled, if the active supervisor engine fails or if a manual switchover is performed, the redundant supervisor engine becomes the active supervisor engine. The redundant supervisor engine is automatically initialized with the startup configuration of the active supervisor engine. This shortens the switchover time from 30 seconds or longer in RPR mode, depending on the configuration, and a subsecond in SSO mode.

In addition to the reduced switchover time, supervisor engine redundancy supports these features:

- Online insertion and removal (OIR) of the redundant supervisor engine.

  Supervisor engine redundancy allows OIR of the redundant supervisor engine for maintenance. When the redundant supervisor engine is inserted, the active supervisor engine detects it. The redundant supervisor engine boots into a partially−initialized state in RPR mode and a fully−initialized state in SSO mode.
- Software upgrade.

  Load the new image on the redundant supervisor engine and conduct a switchover. This minimizes downtime during software changes on the supervisor engine.

When power is first applied to a switch, the supervisor engine that boots first becomes the active supervisor engine and remains active until a switchover occurs.

What Can Cause the Switchover to Standby?

These are possible causes that can trigger the failover between the active and standby supervisors:

- Reload of the active supervisor by administrative request (issue the **reload** command)
- Software or hardware forced crash of the active supervisor
- Removal of the active supervisor (OIR)
- Active supervisor does not respond to the keepalive maintained between the active and standby supervisor
- If hardware diagnostic failure on active is detected during the synchronization process (from Cisco IOS Software Release 12.1(13)EW and later)

Note: The **reload** command only reloads the active supervisor. This causes a switchover to the standby supervisor, if present. This behavior is different than the current Catalyst 6500 Integrated Cisco IOS behavior, where the **reload** command causes the whole system to reset.

Route Processor Redundancy

RPR is supported in Cisco IOS Software Release 12.2(12c)EW and later. In this mode, one supervisor is active and operational. The other supervisor is in standby mode and waits for the active supervisor to fail so that it can take over and maintain the operation of the switch. The second supervisor is halted during the bootup sequence and kept in the standby mode. Therefore, the console is not accessible while in that mode. It starts up in a partially−initialized state and is synchronized with the persistent configuration of the active supervisor engine.

What is synchronized?

These are synchronized between the active and standby supervisors:

- startup configuration (issue the **write memory** command)
- boot−variable
- configuration−register
- calendar
- VLAN database

Note: As a part of the standby bootup, the active and standby supervisors exchange Power On Self Test (POST) status. If the standby detects that the active POST fails, it takes over. If the active supervisor detects that the standby POST fails, it displays in the **show module status** command output field for the standby (since 12.1(13)EW).

What is not synchronized?

These are **not** synchronized between the active and standby supervisors:

- running configurations
- routing table and forwarding shortcuts
- MAC−address table
- other dynamic protocols, such as DHCP database

What happens during the switchover?

When standby takes over due to any of the preceding reasons, the standby performs these functions:

- completes the booting sequence
- resets the modules so they can perform self diagnostics
- parses the configuration
- waits for the modules to come online and establish links
- builds routing tables, MAC−address tables, and other dynamic protocols

Packets are forwarded while the tables are built. The typical switchover time is less than one minute.

Configuration

With the RPR mode of redundancy, the configuration is automatically enabled upon discovery of a standby supervisor. No additional configuration is required. Cisco recommends to have this default configuration:

```
Switch#show running-config
Building configuration...

Current configuration : 5592 bytes
!
version 12.1


!--- Output is suppressed.


!
redundancy
 mode rpr
 main-cpu
  auto-sync standard
!
```

Verification of Redundancy

These commands verify supervisor redundancy on the Catalyst 4500:

- The **show module** command can be used to verify whether the redundant Supervisor module exists and is in standby mode. In this output, the supervisor in slot 2 is active, and the supervisor in slot 1 is in standby.

```
Switch#show module

Mod  Ports Card Type                                   Model             Serial No.
 1      2  1000BaseX (GBIC) Supervisor(standby)       WS-X4515          JAB062604LE
 2      2  1000BaseX (GBIC) Supervisor(active)        WS-X4515          JAB062408TV
 3     48  10/100/1000BaseTX (RJ45)                   WS-X4448-GB-RJ45  JAB053606AG
 4     48  10/100BaseTX (RJ45)V                       WS-X4148-RJ45V    JAE060800BL

 M MAC addresses                     Hw  Fw           Sw               Status
 1 0009.e845.6300 to 0009.e845.6301 0.5 12.1(13r)EW( 12.1(13)EW,      Ok
 2 0009.e845.6302 to 0009.e845.6303 0.4 12.1(12r)EW( 12.1(13)EW, EARL Ok
 3 0001.6443.dd20 to 0001.6443.dd4f 0.0                               Ok
 4 0008.2138.d900 to 0008.2138.d92f 1.6                               Ok
```

  If the standby supervisor is in ROM Monitor (ROMmon), this output displays:

```
Switch#show module

Mod  Ports Card Type                                   Model             Serial No.
 1         Standby Supervisor
 2      2  1000BaseX (GBIC) Supervisor(active)        WS-X4515          JAB062408TV
 3     48  10/100/1000BaseTX (RJ45)                   WS-X4448-GB-RJ45  JAB053606AG
 4     48  10/100BaseTX (RJ45)V                       WS-X4148-RJ45V    JAE060800BL

 M MAC addresses                     Hw  Fw           Sw               Status
 1 Unknown                               Unknown      Unknown          Other
 2 0009.e845.6302 to 0009.e845.6303 0.4 12.1(12r)EW( 12.1(13)EW, EARL Ok
 3 0001.6443.dd20 to 0001.6443.dd4f 0.0                               Ok
 4 0008.2138.d900 to 0008.2138.d92f 1.6
```

- The **show redundancy state** command can be used to verify whether the redundant supervisor is in redundant mode as expected.

```
Switch#show redundancy states
       my state = 13 -ACTIVE
     peer state = 4  -STANDBY COLD

!--- Indicates RPR mode.
```

```
            Mode = Duplex

!--- Indicates secondary is present and in redundant state.

            Unit = Primary

!--- Always is primary because this is RPR mode.

          Unit ID = 2

!--- Slot number of active.


Redundancy Mode (Operational) = RPR

!--- Indicates redundancy mode.

Redundancy Mode (Configured)  = RPR
     Split Mode = Disabled
   Manual Swact = Enabled
 Communications = Up

   client count = 4
 client_notification_TMR = 60000 milliseconds
          keep_alive TMR = 9000 milliseconds
         keep_alive count = 0
    keep_alive threshold = 18
           RF debug mask = 0x0
```

If the standby module is not operational because it is in ROMmon or other reasons, or it is not present, this output displays:

```
Switch#show redundancy states
       my state = 13 -ACTIVE
     peer state = 1  -DISABLED

!--- Standby supervisor is not up or not present.

            Mode = Simplex

!--- Not redundant.

            Unit = Primary
          Unit ID = 2

Redundancy Mode (Operational) = RPR
Redundancy Mode (Configured)  = RPR
     Split Mode = Disabled
   Manual Swact = Disabled  Reason: Simplex mode
 Communications = Down      Reason: Simplex mode

   client count = 4
 client_notification_TMR = 60000 milliseconds
          keep_alive TMR = 9000 milliseconds
         keep_alive count = 0
    keep_alive threshold = 18
           RF debug mask = 0x0
```

Manual Switchover Commands

These commands can be used to perform manual switchover or power−cycle of the supervisor:

- **reload** This reloads the current active supervisor in order to perform a switchover to the standby.

Note: On Catalyst 6500s that run Cisco IOS Software Release 12.1(11)EX or 12.1(13)E and later, the **reload** command reloads the entire chassis.

- **redundancy reload peer** This reloads the standby supervisor. This command is used to keep the downtime to a minimum while it performs upgrades to both supervisors. Download the new IOS in both supervisor bootflashes and change the boot variable to load the new image. Reload the standby with this command so that it comes up with the new IOS. Issue the **reload** command to failover to standby in order to reload the active supervisor. The current active supervisor loads the new IOS and returns in standby mode. Both the supervisors run the new release of IOS.
- **redundancy reload shelf** This reloads the entire shelf or chassis. Unlike Catalyst 6500s that run Integrated Cisco IOS, there is no guarantee that the current active supervisor is active after the boot process.

Stateful Switchover

SSO is supported in Cisco IOS Software Release 12.2(20)EWA and later. When a redundant supervisor engine runs in SSO mode, it starts up in a fully−initialized state and synchronizes with the persistent configuration and the running configuration of the active supervisor engine. It subsequently maintains the state on the protocols, and all changes in hardware and software states for features that support SSO are kept in−sync. Consequently, it offers zero interruption to Layer 2 sessions in a redundant supervisor engine configuration.

Because the redundant supervisor engine recognizes the hardware link status of every link, ports that were active before the switchover remain active. This includes the uplink ports. However, because uplink ports are physically on the supervisor engine, they are disconnected if the supervisor engine is removed.

If the active supervisor engine fails, the redundant supervisor engine becomes active. This newly active supervisor engine uses Layer 2 switching information that exists to continue forwarding traffic. Layer 3 forwarding is delayed until the routing tables have been re−populated in the newly active supervisor engine.

What is synchronized?

SSO supports these Layer 2 features. The state of these features is preserved between both the active and redundant supervisor engines:

- 802.3
- 802.3u
- 802.3x (Flow Control)
- 802.3ab (Gigabit Ethernet [GE])
- 802.3z (GE including Coarse Wave Division Multiplexing [CWDM])
- 802.3ad (Link Aggregation Control Protocol [LACP])
- 802.1p (Layer 2 QoS)
- 802.1q
- 802.1X (Authentication)
- 802.1D (Spanning Tree Protocol [STP])
- 802.3af (Inline power)
- Port Aggregation Protocol (PAgP)
- Virtual Terminal Protocol (VTP)
- Dynamic Address Resolution Protocol (ARP) Inspection
- DHCP snooping
- IP source guard
- Internet Group Management Protocol (IGMP) snooping (versions 1 and 2)
- Distributed Diagnostics and Service Network (DDSN) Transfer Protocol (DTP) (802.1q and Inter−Switch Link [ISL])
- Multiple Spanning Tree (MST)

- Per−VLAN Spanning Tree (PVST+)
- Rapid−PVST
- PortFast/UplinkFast/BackboneFast
- Bridge Protocol Data Unit (Bpdu) guard and filtering
- Voice VLAN
- Port security
- Unicast MAC filtering
- Access Control List (ACL) (VLAN Access Control List [VACLS], Port Access Control List [PACLS], Receive Access Control List [RACLS])
- QoS (Dynamic Buffer Limiting [DBL])
- Multicast storm control/broadcast storm control

What is not synchronized?

These are not synchronized between the active and standby supervisors:

- All Layer 3 protocols on Catalyst 4500 Series Switches (Switch Virtual Interfaces)

Cisco NonStop Forwarding (NSF) works with SSO to minimize the amount of time that a Layer 3 network is unavailable after a supervisor engine switchover by continuing to forward IP packets. The reconvergence of Layer 3 routing protocols (Border Gateway Protocol [BGP], Enhanced Interior Gateway Routing Protocol [EIGRP], Open Shortest Path First [OSPF] v2, and Intermediate System−to−Intermediate System [IS−IS]) is transparent to the user and occurs automatically in the background. The routing protocols recover routing information from neighbor devices and rebuild the Cisco Express Forwarding (CEF) table. Refer to Configuring NSF with SSO Supervisor Engine Redundancy for more information.

SSO is compatible with this list of features. However, the protocol database for these features is not synchronized between the redundant and active supervisor engines.

- 802.1Q tunneling with Layer 2 Protocol Tunneling
- Baby giants
- Jumbo frame support
- Cisco Discovery Protocol (CDP)
- Flood blocking
- Unidirectional Link Detection Protocol (UDLD)
- Switched Port Analyzer (SPAN)/Remote Switch Port Analyzer (RSPAN)
- NetFlow

Configuration

Issue these commands in order to configure the redundancy in SSO mode:

```
Switch#configure terminal
Switch(config)#redundancy
Switch(config−red)#mode sso
```

Verification of Redundancy

These commands verify supervisor redundancy on the Catalyst 4500 Series Switches:

- **show module** This verifies whether the redundant Supervisor module exists and is in standby mode.
- **show redundancy** This verifies the redundancy facility information.

```
Switch#show redundancy
Redundant System Information :
```

```
       Available system uptime = 2 days, 2 hours, 39 minutes
Switchovers system experienced = 0
             Standby failures = 0
        Last switchover reason = none

                 Hardware Mode = Duplex
    Configured Redundancy Mode = Stateful Switchover
     Operating Redundancy Mode = Stateful Switchover
              Maintenance Mode = Disabled
                Communications = Up

Current Processor Information :
               Active Location = slot 1
        Current Software state = ACTIVE
       Uptime in current state = 2 days, 2 hours, 39 minutes
                 Image Version = Cisco Internetwork Operating System Software
IOS (tm) Catalyst 4000 L3 Switch Software (cat4000-I5S-M), Version 12.2(20)EWA(3
.92), CISCO INTERNAL USE ONLY ENHANCED PRODUCTION VERSION
Copyright (c) 1986-2004 by cisco Systems, Inc.
Compiled Wed 14-Jul-04 04:42 by esi
                           BOOT = bootflash:cat4000-i5s-mz.122_20_EWA_392,1
        Configuration register = 0x2002

Peer Processor Information :
              Standby Location = slot 2
        Current Software state = STANDBY HOT
       Uptime in current state = 2 days, 2 hours, 39 minutes
                 Image Version = Cisco Internetwork Operating System Software
IOS (tm) Catalyst 4000 L3 Switch Software (cat4000-I5S-M), Version 12.2(20)EWA(3
.92), CISCO INTERNAL USE ONLY ENHANCED PRODUCTION VERSION
Copyright (c) 1986-2004 by cisco Systems, Inc.
Compiled Wed 14-Jul-04 0
                           BOOT = bootflash:cat4000-i5s-mz.122_20_EWA_392,1
        Configuration register = 0x2002
```

- **show redundancy states** This can be used to verify whether the redundant supervisor is in redundant mode as expected.

```
Switch#show redundancy states
my state = 13 -ACTIVE
     peer state = 8  -STANDBY HOT
           Mode = Duplex
           Unit = Primary
        Unit ID = 2
Redundancy Mode (Operational) = Stateful Switchover
Redundancy Mode (Configured)  = Stateful Switchover
     Split Mode = Disabled
   Manual Swact = Enabled
 Communications = Up

   client count = 21
 client_notification_TMR = 240000 milliseconds
          keep_alive TMR = 9000 milliseconds
        keep_alive count = 0
    keep_alive threshold = 18
           RF debug mask = 0x0
```

Manual Switchover Commands

Manual switchover commands can be used to perform manual switchover from the active supervisor to the redundant supervisor engine.

The **redundancy force-switchover** command launches the switchover only if the state of the redundant supervisor engine is Standby Hot. If the state is not Standby Hot, the command does not process. Issue the **redundancy force-switchover** command, rather than the **reload** command, to initiate a switchover. The

redundancy force−switchover command first checks that the redundant supervisor engine is in the correct state. If you issue the **reload** command and the status is not Standby Hot, the **reload** command only resets the current supervisor engine.

Access the Standby Supervisor

The Catalyst 4500 Supervisor IV in a 4507R allows the active supervisor to perform activities on the standby supervisor devices. This table lists some of the common activities.

Commands	Description
dir slavebootflash: or **dir slaveslot0:**	Used to list the contents of the standby bootflash: device or slot0:
delete slavebootflash:<*filename*> or **delete slaveslot0:**<*filename*>	Used to delete a specific file name from the standby devices.
squeeze slavebootlflash: or **squeeze slaveslot0:**	Used to perform the squeeze function after delete to recover the device space.
format slavebootflash: or **format slaveslot0:**	Used to format the standby devices.
copy <*source*> **slavebootflash:** or **copy** <*source*> **slaveslot0:**	Used to copy files to the standby devices. Source device can be TFTP or active supervisor devices.

Issue the **show diagnostics power−on standby** command in order to access the standby supervisor power−on diagnostics.

Supervisor Uplink Redundancy

In the Catalyst 4500 Series, if Supervisor redundancy has been configured, only specific uplink ports are active and available for uplink connectivity. If you try to configure other uplink ports, an error message

similar to this displays:

```
Cat4500(config)#interface GigabitEthernet1/2
% WARNING: Interface GigabitEthernet1/2 is usable/operational
% only when this is the only supervisor present.
```

In order to know the ports available for uplink, see the next sections.

Supervisor II−Plus or Supervisor IV

Catalyst 4500 Supervisor II−Plus (WS−X4013+) or Supervisor IV (WS−X4515) has two GE uplink interfaces per supervisor. This table illustrates how the uplink provides redundancy in a 4507R Chassis in various combinations of the two supervisors in the supervisor slots.

Uplink Interface	Slot 1: Supervisor II−Plus or IV Slot 2: Empty	Slot 1:Empty Slot2: Supervisor II−Plus or IV	Slot1: Supervisor II−Plus or IV Slot2: Supervisor II−Plus or IV
GE 1/1	**Active**	N/A	**Active**
GE 1/2	**Active**	N/A	Not Active
GE 2/1	N/A	**Active**	**Active**
GE 2/2	N/A	**Active**	Not Active

Interface 1/1 and 2/1 are active when both supervisors are present and work in redundant mode.

Note: The GE port 2/1 works normally even if the second supervisor is in ROMmon mode. Cisco recommends that the standby supervisor be in normal mode so that redundancy can be performed.

Note: Redundancy requires that both supervisor engines in the chassis are of the same supervisor engine model, and to use the same Cisco IOS software image.

Supervisor V

Catalyst 4500 Supervisor V (WS−X4516) has two GE uplink interfaces per supervisor. This table illustrates how the uplink provides redundancy in a 4507R or 4510R Chassis in various combinations of the two supervisors in the supervisor slots.

Uplink Interface	Slot 1: Supervisor V Slot 2: Empty	Slot 1:Empty Slot2: Supervisor V	Slot1: Supervisor V Slot2: Supervisor V
GE 1/1	**Active**	N/A	**Active**
GE 1/2	**Active**	N/A	**Active**
GE 2/1	N/A	**Active**	**Active**
GE 2/2	N/A	**Active**	**Active**

Supervisor II Plus 10GE or Supervisor V 10GE

Catalyst 4500 Supervisor II Plus 10GE (WS−X4013+10GE) or Supervisor V 10GE (WS−X4516−10GE) has four GE uplink interfaces and two 10 GE uplink interface per Supervisor. This table illustrates how the uplink provides redundancy in a 4507R or 4510R Chassis in various combinations of the two supervisors in the supervisor slots.

In Cisco IOS Software Release 12.2(25)SG and later on a Catalyst 4507R Series Switch, 10GE and GE uplinks are concurrently usable on the Supervisor Engine V−10GE (WS−X4516−10GE) and the Supervisor Engine II+10GE (WS−4013+10GE). In Cisco IOS Software Releases earlier than 12.2(25)SG, you need to issue the **hw−module uplink select** configuration command to select either the 10GE or GE uplinks.

In Cisco IOS Software Release 12.2(25)SG and later, when you use a Supervisor Engine V−10GE (WS−X4516−10GE) on a Catalyst 4510R Series Switch, you can select to use both the 10GE and GE uplinks concurrently, but only with a WS−X4302−GB in slot 10. If either the 10GE or GE uplinks are selected, then any linecard is allowed in slot 10. Issue the **hw−module uplink select** configuration command to select the uplinks. In Cisco IOS Software Releases earlier than 12.2(25)SG, you cannot use the 10GE and GE uplinks concurrently. The Cisco Catalyst 4000 NetFlow Services Card (WS−F4531) is an optional daughter card for the Catalyst 4000/4500 Supervisor Engine IV or Supervisor Engine V. In the Supervisor Engine V−10GE, the NetFlow functionality is embedded in the supervisor engine itself. It extends the functions of the supervisor engine as it collects NetFlow statistics and enhanced Virtual LAN (VLAN) statistics without any affect on the forwarding performance rates of the supervisor engine. The Catalyst 4500 series switches supports the functionality of monitoring traffic in the same broadcast domain only when the 10GigE Supervisor is used. It is not supported on the Supervisor Engine I, II, or III.

Note: Redundancy requires that both supervisor engines in the chassis are of the same supervisor engine model, and to use the same Cisco IOS software image.

If only 10GE ports are selected for uplink:

Uplink Interface	Slot 1: Supervisor II Plus 10GE or V 10 GE Slot 2: Empty	Slot 1:Empty Slot2: Supervisor II Plus 10GE or V 10 GE	Slot1: Supervisor II Plus 10GE or V 10 GE Slot2: Supervisor II Plus 10GE or V 10 GE
10GE 1/1	**Active**	N/A	**Active**
10GE 1/2	**Active**	N/A	Not Active
10GE 2/1	N/A	**Active**	**Active**
10GE 2/2	N/A	**Active**	Not Active

If only GE ports are selected for uplink:

Uplink Interface	Slot 1: Supervisor II Plus 10GE or V 10 GE	Slot 1:Empty Slot2: Supervisor II Plus 10GE or V	Slot1: Supervisor II Plus 10GE or V 10 GE

	Slot 2: Empty	10 GE	Slot2: Supervisor II Plus 10GE or V 10 GE
GE 1/3	**Active**	N/A	**Active**
GE 1/4	**Active**	N/A	**Active**
GE 1/5	**Active**	N/A	Not Active
GE 1/6	**Active**	N/A	Not Active
GE 2/3	N/A	**Active**	**Active**
GE 2/4	N/A	**Active**	**Active**
GE 2/5	N/A	**Active**	Not Active
GE 2/6	N/A	**Active**	Not Active

If both 10GE and GE ports are selected for uplink:

Uplink Interface	Slot 1: Supervisor II Plus 10GE or V 10 GE Slot 2: Empty	Slot 1:Empty Slot2: Supervisor II Plus 10GE or V 10 GE	Slot1: Supervisor II Plus 10GE or V 10 GE Slot2: Supervisor II Plus 10GE or V 10 GE
10GE 1/1	**Active**	N/A	**Active**
10GE 1/2	**Active**	N/A	Not Active
10GE 2/1	N/A	**Active**	**Active**
10GE 2/2	N/A	**Active**	Not Active
GE 1/3	**Active**	N/A	**Active**
GE 1/4	**Active**	N/A	**Active**
GE 1/5	**Active**	N/A	Not Active
GE 1/6	**Active**	N/A	Not Active
GE 2/3	N/A	**Active**	**Active**
GE 2/4	N/A	**Active**	**Active**
GE 2/5	N/A	**Active**	Not Active
GE 2/6	N/A	**Active**	Not Active

Frequently Asked Questions

- **There is a restriction to only use some uplinks for Supervisor II Plus, Supervisor II Plus 10GE, Supervisor IV, and Supervisor V 10GE. Will this be fixed in future software releases for supervisors?**

No, the restrictions to only use some uplinks is due to the hardware design of the supervisors. Therefore, this will not be fixed in any new software releases.

- **The standby supervisor is not fully booted up. How is the uplink port on it usable?**

  The hardware is designed so that the standby supervisor is actually controlled by the active supervisor engine. Therefore, it is usable. The standby supervisor port works even if the standby supervisor is in ROMmon mode.
- **Standby supervisor uplink port is amber, even though the link is up and in the STP `forwarding` state. Is this normal?**

  In Cisco IOS Software Releases 12.1(12c)EW and 12.1(13)EW, this behavior is expected. Cisco bug ID CSCea34258 (registered customers only) is filed to track the issue. This is a cosmetic issue and has no impact on switch performance. It has been resolved in Cisco IOS Software Releases 12.1(19)EW or later.
- **The active supervisor failed, and there was a switchover. Will the syslog server report this event?**

  If there is a syslog server configured, it reports if the active supervisor failed and also reports that the standby supervisor took over the active one. The syslog server captures the failover information and detailed events when a failover occurs when you have redundant supervisors.

  This scenario applies when the active supervisor was either physically removed or had a software forced crash, and the standby had to take over as the active supervisor.
- **What is the recommended configuration for a single supervisor setup in a 4507R / 4510R chassis? Does redundancy need to be disabled in the configuration to prevent problems?**

  Redundancy need not be disabled in the switch. You can have redundancy enabled and configuration untouched. This is useful if you decide to have redundancy and put in another supervisor engine; they automatically synchronize the image and communicate the redundancy. You do not need further configuration changes. As long as there is only one supervisor engine in the chassis, the switch is in simplex mode because no other supervisor engine is detected in the chassis.

General Considerations When the Active Supervisor in a Redundant Supervisor Chassis is Removed

Caution should be exercised if you pull out the active supervisor in the dual supervisor scenario. Assume that you have two supervisors with the supervisor in slot1 active. Based on the previous section, Gigabits 1/1 and 2/1 are active. At this moment, the startup configuration has configurations for both Gigabits 1/1 and 2/1 saved.

If the active supervisor is removed, the standby supervisor becomes active and begins to come online. The standby supervisor parses the startup configuration and finds that the supervisor in slot 1 does not exist. The standby supervisor prints an error message that GE 1/1 does not exist.

If you reinsert the supervisor in slot 1, the supervisor is recognized and is in standby mode. However, the running configuration on the current active supervisor does not have a configuration specific to Gigabits 1/1 or 1/2.

The workaround is to issue the **copy start−config running−configuration** command in order to copy the startup configuration to the running configuration.

Note: Do not issue the **write memory** command before you copy the startup configuration to the running configuration. This results in default configurations for Gigabits 1/1 and 1/2 written to the startup

configuration.

Note: Similar behavior is also seen if a linecard is physically removed from the chassis and the supervisor is switched over. The new active supervisor also prints an error message for the missing linecard. Issue the **copy start run** command once the linecard is inserted back into the chassis.

Power Supply Redundancy

Catalyst 4500 Series Switches provide 1+1 redundancy for power supply. The power supply can also run in a combined mode so that chassis can supply power with the combined power. All 4500 Chassis support this power supply redundancy feature.

Catalyst 4500s support power supply redundancy only between power supplies of equal wattage and type (AC/DC). A mix of power supplies is not supported. The second power supply recognized is placed into err−disable mode.

Refer to this table for the effect in each of the configuration changes.

Configuration Change	Effect
Redundant to combined (equal wattage/type power supplies installed).	• System log and syslog messages are generated. • System power is not the sum of two power supplies. It is P+ (P * ratio). Refer to the Available Power for Catalyst 4500 Series Switches Power Supplies section of the product documentation for more information. • The modules marked as *power−deny* in the **show module** command output status field are brought up if there is sufficient power.
Combined to redundant (equal wattage/type power supplies installed).	• System log and syslog messages are generated. • System power is the power capability of a single power supply. The power supply that is recognized first is the one that supplies the power. • If there is not enough power for all previously powered−up modules, some modules are powered down and marked as *power−deny* in the **show module** command output status field.

Equal wattage power supply is inserted with redundancy enabled.	• System log and syslog messages are generated. • System power equals the power capability of one power supply that already works. • No change in the module status because the power capability is unchanged.
Equal wattage power supply is inserted with combined mode enabled (redundancy disabled).	• System log and syslog messages are generated. • System power is not the sum of two power supplies. It is P+ (P * ratio). Refer to the Available Power for Catalyst 4500 Series Switches Power Supplies section of the product documentation for more information. • The modules marked as *power−deny* in the **show module** command output status field are brought up if there is sufficient power.
Higher or lower wattage power supply is inserted.	• System log and syslog messages are generated. • System power remains the same. • The newly inserted power supply is kept in err−disabled mode. • No change in the module status because the power capability is unchanged.
Different type (AC/DC) power supply is inserted.	• System log and syslog messages are generated. • System power remains the same. • The newly inserted power supply is kept in err−disabled mode. • No change in the module status because the power capability is unchanged.
Power supply is removed with redundancy enabled	• System log and syslog messages are generated.

	• There is no change in the module status because the power capability is unchanged.
Power supply is removed with combined mode enabled (redundancy disabled).	• System log and syslog messages are generated. • System power is decreased to the power capability of one supply. • If there is not enough power for all previously powered−up modules, some modules are powered down and marked as *power−deny* in the **show module** command output status field.
System is booted with power supplies of different wattage, or different types are installed and redundancy is enabled or combined enabled.	• System log and syslog messages are generated. • System power is equal to the first recognized power supply. • The power supply recognized second is kept in err−disabled mode.
System is booted with power supplies of equal wattage and type installed in combined more (redundancy disabled).	• System log and syslog messages are generated. • System power is not the sum of two power supplies. It is P+ (P * ratio). Refer to the Available Power for Catalyst 4500 Series Switches Power Supplies section of the product documentation for more information. • The system powers−up as many modules as the combined capacity allows.

Configuration

The default power supply management mode is to use redundant mode. Issue this command to change the mode to combined:

```
Switch (config)#power redundancy−mode combined
```

Issue this command to change the mode to redundant:

```
Switch (config)#power redundancy-mode redundant
```

Verification

Issue the **show power** command in order to verify the power supply management mode and to check the status of the power supply:

```
C4507-A#show power
Power                                              Fan     Inline
Supply  Model No          Type       Status        Sensor  Status
PS1     PWR-C45-1400AC    AC 1400W   good          good    n.a.
PS2     none              --         --            --      --

Power Summary
 (in Watts)    Available   Used   Remaining
System Power     1360       220     1140
Inline Power        0         0        0
Maximum Power    1400       220     1180

Power supplies needed by system : 1

!--- Indicates redundant mode of operation.
```

The Catalyst 4500 does not support a mix of power supplies of different wattage or types (AC/DC) in the same chassis. The second recognized power supply is err-disabled.

```
4507#show power
Power                                              Fan     Inline
Supply  Model No          Type       Status        Sensor  Status
PS1     PWR-C45-2800AC    AC 2800W   good          good    good
PS2     PWR-C45-1000AC    AC 1000W   err-disable   good    n.a.

!--- Second recognized power supply is err-disabled.


*** Power Supplies of different type have been detected***

!--- A mix of power supplies not supported.


Power Supply    Max     Min     Max     Min     Absolute
(Nos in Watts)  Inline  Inline  System  System  Maximum
PS1             1400    1400    1360    1360    2800
PS2                0       0       0       0       0

!--- No power drawn from second power supply.


Power Summary
 (in Watts)    Available   Used   Remaining
System Power     1360       450      910
Inline Power     1400        18     1382
Maximum Power    2800       468     2332

Power supplies needed by system : 1

!--- Switch configured for redundant mode.


                          Power Used  Power Used
Mod   Model                (online)   (in Reset)
 1    WS-X4515               110          110
 2    WS-X4515               110          110
```

```
3    WS-X4448-GB-RJ45        120             72
4    WS-X4148-RJ45V           60             50
```

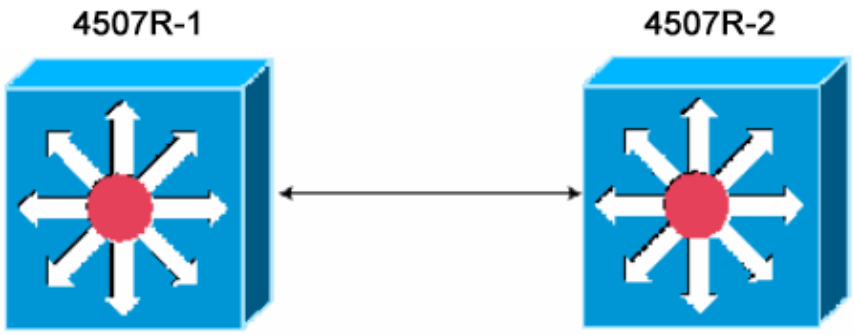
Note: If the power supply is not powered−up, the status might be reported as **bad**. The syslog indicates that the power supply has failed. Make sure that the power supply is actually powered−up before you troubleshoot the failed power supply.

Note: Refer to the Power Management section of the product documentation for more information about power redundancy.

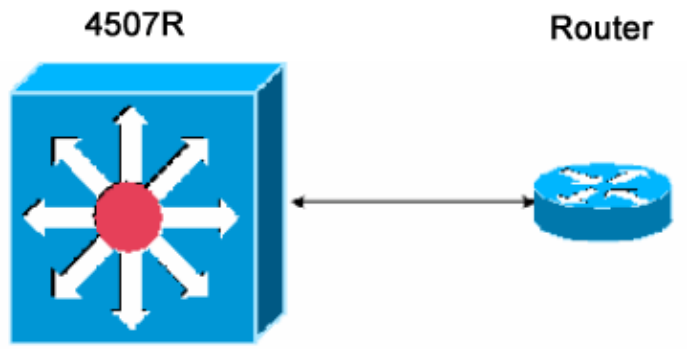
HSRP

HSRP provides network redundancy for IP networks with a virtual gateway for hosts in the subnets. HSRP is enabled on two routing devices in a subnet. The routing devices provide a single virtual IP address that can be used as a default gateway IP address on hosts in the subnet. The routing devices elect an active and standby router between them and the active router performs packet forwarding from that subnet. When the active HSRP router fails, the standby becomes the active router and continues the gateway services with the same IP address. No change in host gateway configuration is required.

Catalyst 4500 Supervisor IV supports HSRP and M−HSRP. HSRP should be configured between the 4500 Supervisor on two different chassis, as shown in this diagram.



4500 Supervisors can also form HSRP with another external switch or router, as shown in this diagram. The supervisor cannot form HSRP within the same chassis because the standby supervisor is in suspended mode.



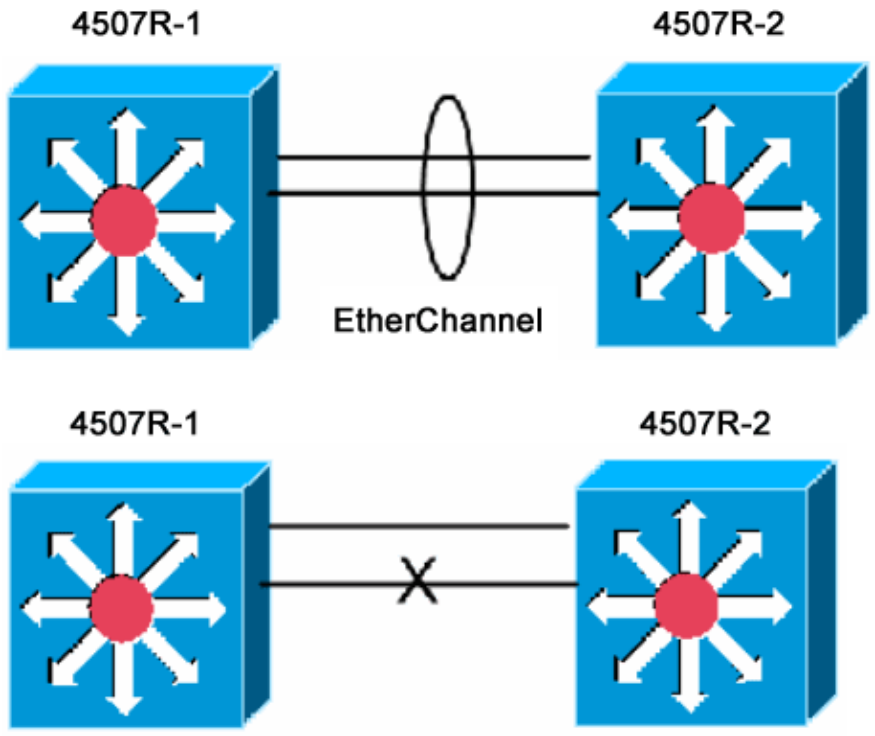
Supervisor IV supports up to 256 HSRP group IDs in the range of 0−255.

The HSRP configuration is similar to IOS routers. Refer to Hot Standby Router Protocol Features and Functionality and Understanding and Troubleshooting HSRP Problems in Catalyst Switch Networks for more information.

Port−Channel

EtherChannel features provide redundancy between switches, switch to router, or switch to server connection by bundling up to eight links. If one of the links fails within the channel, the communication between the devices is maintained through the links that remain. You can bundle FastEthernet or GE ports. EtherChannel provides higher bandwidth connections as well. For example, eight port Gigabit EtherChannel (GEC) provides up to 8 GB full−duplex bandwidth between the switches.

These diagrams show how EtherChannel protects against link failures and still maintains connectivity between the devices.



Catalyst 4500 Supervisor IV supports PAgP and LACP (since 12.1(13)EW) EtherChannel protocols. LACP, which is 803.2ad, is an IEEE standard that allows channeling between Catalyst 4500s with other vendor devices. PAgP is used for channeling between Cisco devices. The supervisor also supports Layer 2 as well as Layer 3 EtherChannel configurations. Refer to Understanding and Configuring EtherChannel for more information.

Summary

Catalyst 4500s with Supervisor IV provide many features that enhance the availability of these switches in networks. They provide redundancy for supervisors, uplinks, and power supplies. They also support redundancy features, such as HSRP and port−channel. This document discussed some of the caveats or limitation of these features. The Catalyst 4500 is an evolving platform and many of the features will be enhanced in future software and hardware releases.

Related Information

- **Configuring Supervisor Engine Redundancy on the Catalyst 4507R**
- **Environmental Monitoring and Power Management on Catalyst 4500**
- **Understanding and Troubleshooting HSRP Problems in Catalyst Switch Networks**

- **Understanding and Configuring EtherChannel**
- **Catalyst 4500 Support Page**
- **Catalyst 4500 Configuration Guide**
- **Technical Support & Documentation − Cisco Systems**

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